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Analysis of Reproduction and Fattening Performances of Pigs under Small Scale Intensive Farming in East Shewa, Ethiopia

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Abstract: In the Oromia regional state of Ethiopia, pigs are raised by smallholders in areas of major towns such as Addis Ababa, Bishoftu and Adama. Unfortunately, little information is available regarding reproduction and fattening performances of pigs in the East Shewa of central Oromia, Ethiopia wherefore a baseline survey was conducted during January 2014 to April 2015. A total of 105 households were selected using a stratified sampling method and interviewed with a structured questionnaire. The results revealed that the mean service per conception of sows in Addis Ababa (1.6±0.5) and Adama (1.5±0.5) was greater than the value obtained in Bishoftu (1.2±0.4). The mean age at first service of pigs was significantly lower (p<0.05) in Bishoftu (4.2±0.45) compared to Addis Ababa (4.6±0.6) and Adama (5.1±0.51) towns. The mean age at first furrowing of pigs was significantly lower (p<0.05) in Bishoftu (8.2±0.4) compared to in Addis Ababa (8.7±0.5) and Adama (8.7±0.5). The mean number of furrowing/sow/year was significantly greater in Bishoftu (2.4±0.6) compared to in Addis Ababa (1.9±0.4) and Adama (2.0±0.4). The mean litter size at weaning of pigs was significantly lower in Addis Ababa (3.3±0.7) and Adama (2.9±0.3) than Bishoftu (8.8±1.1) town. The mean value of live weight at birth was significantly higher (p<0.05) in Bishoftu (0.8±0.1) than in Addis Ababa (0.61±0.1) and Adama (0.7±0.1). The live weight at weaning of pigs in Addis Ababa (5.5±0.6) and Adama (5.3±0.5) was lighter compared to Bishoftu (7.5±0.6).The mean Pre-weaning piglet mortality was higher (p<0.05) in Addis Ababa (3.86±0.55) and Adama (4.17±0.65) than Bishoftu (2.18±0.71). There was significantly shorter (p<0.05) fattening period and higher (p<0.05) market weight of pigs in Bishoftu than in Addis Ababa and Adama. The study indicated that there were remarkable variations among the study sites in terms of reproduction and fattening performances of pigs. It could be concluded that an improvement of small scale intensive pig production system to increase animal protein sources should consider the divergent reproduction and fattening performances of the three towns.

Key words: Small scale · Intensive production · Reproduction · Fattening · Pig

INTRODUCTION

Pig production plays an important role in improving the incomes, bridging animal protein supply gap, enhancing employment status of small-scale farmers and itis the key element for reducing poverty of the poor [1-3]. Pig production efficiency in commercial pig production is partially dependent up on reproductive performance.This could be determined by the number of piglets at birth, at weaning, furrowing /sow/year, birth weight, weaning weight, age at first service, age at first furrowing, furrowing interval [4-6]. Similarly, the pig grows from 1.5 kg at birth to a slaughter weight 100–120 kg in about 5 months.

It reproduces at a high rate because it is a litter-bearing species [7]. The sow is pregnant 114 days, gives birth to 10–15 piglets per litter and normally produces two litters a year [8]. The feed energy requirements per kilogram of meat produced are 45 MJ/ kg carcass as compared with 100–180 MJ/ kg for cattle and 25 MJ/ kg for chicken [9]. Poor reproductive performance of pigs could negatively affect the economic benefit of a pig enterprise

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[10]. The annual total economic loss due to disease, mortality, reduced production and reproduction performance was estimated as 150 million USD [11].

This suggests that, it is unquestionably difficult to sustain successful pig production without understanding the reproductive and growth performance of pigs. Knowledge of small scale intensive pig production in relation to reproduction and growth performance is still scarce in East Shewa central Oromia, Ethioia. The current gap of information could hamper to device scientific intervention and sustainable development of pig production. Therefore, the present study was conducted with the purpose of determining reproduction and growth performances of small scale intensive pig production in East Shewa central Oromia, Ethiopia. It is anticipated that the findings will help to design and implement sustainable policies and strategies on pig farming, in order to break the vicious cycle of poverty, under nutrition and disease.

MATERIALS AND METHODS

Description of the Study Area: The study was undertaken in three towns: Addis Ababa, Bishoftu and Adama that are located in the central parts of Oromia region, Ethiopia, in place of highland, midland and lowland agro ecologies, correspondingly. Addis Ababa is sited at 9° N latitude 38°E longitude and average altitude of 2355 meters above sea level; Bishoftu is placed at 9°N latitude and 40°E longitudes at an altitude of 1850 meters above sea level; Adama is placed at 8°N latitude and 39°E longitude 1400 meter above sea level. The study areas have formerly been explained exhaustively [2].

Determination of the Sample Size: The sample size was deteremined using Arsham's [12] formula: $N=0.25/SE^2$ Where N = Sample Size and SE = Standard Error thus Standard Error of 0.05 with 95% confidence level was used to calculate the sample size (105 households) considered during the current study.

Data Collection Procedure: A baseline survey was conducted from January 2014 to April 2015 using a structured questionnaire in collaboration with data collectors' employed and trained for this reason under close supervision by the investigator. The questionnaire was designed to collect information on reproduction and fattening performance of pig farming. The number of household's interviewed in Addis Ababa, Bishoftu and Adama was 35, 40 and 30 respectively which were proportional to size. Purposive sampling technique was used to select towns based on availability of pig production.

Statistical Analysis: The data regarding reproduction and fattening performance of pig farming were analyzed by one way ANOVA and descriptive statistics of statistical package for social sciences [13]. The mathematical formula used in the present study included:

$Y_{ij}= \mu + T_i + \varepsilon_{ij}$, Where,
Y_{ij}= Response variables
μ = Overall mean
T_i = Effect of towns where i = 1 is Addis Ababa, i = 2 is Bishoftu and i = 3 is Adama.
εij = is errors with normal distribution, N (0, I).

RESULTS AND DISCUSSION

Economically Important Traits of Small Scale Intensive Pig Production in East Shewa: The performance traits of small scale intensive pigs in east Shewa were shown in Table 1. Age at first service, services per conception, age at first furrowing, furrowing interval, number of furrowing/sow/year, litter size at weaning, birth weight, weaning weight and pre-weaning mortality were different (p<0.05) across the study sites.

The mean age at first service of pigs was significantly lower (p<0.05) in Bishoftu compared to Addis Ababa and Adama towns. The results indicated that there was shorter age at first service of pig production in Bishoftu which could be explained by increased furrowing rate. Sows with long age at first service often have decreased furrowing rates and litter sizes compared to sows with shorter age at first mating [14]. Numerous studies have found that an inadequate intake of energy or protein during lactation affects body fat and protein reserves and prolongs the age at first service. The average age at first service could be determined by many factors including season, environmental temperature, photoperiod, nutrition, stress, facility design, lactation length and management practices [14]. The results were lower than reports of Okello *et al*. [15].

The mean services per conception of sows in Addis Ababa and Adama were greater than the value obtained in Bishoftu. The results might demonstrate that there were larger numbers of repeat breeders in pig production of Addis Ababa and Adama than in Bishftu. The present results were concurrent with reports of Losada *et al.* [16].

Table 1: Reproduction performance traits of small scale intensive pig production in East Shewa

	Towns					
	Addis Ababa	Bishoftu	Adama	Total	*Test*	
Traits	Mean± SD	Mean± SD	Mean± SD	Mean± SD	*F-value*	*p-value*
Age at first service (month)	4.6±0.6[a]	4.2±0.45[b]	5.1±0.51[c]	4.6±0.6	30.999	0.0
Service per conception	1.6±0.5[a]	1.2±0.4[b]	1.5±0.5[a]	1.4±0.5	8.42	0.0
Age at first furrowing (month)	8.7±0.5[a]	8.2±0.4[b]	8.7±0.5[a]	8.5±0.5	12.79	0.0
Furrowing interval (month)	2.3±0.4[a]	2.0±0.0[b]	2.9±0.4[c]	2.3±0.5	66.21	0.0
Number of furrowing/sow/year	1.9±0.4[a]	2.4±0.6[b]	2.0±0.4[c]	2.1±0.5	8.3	0.0
Gestation period (day)	113.9±0.3[a]	113.8±0.5[a]	113.9±0.3[a]	113.9±0.4	0.75	0.48
Litter size at birth	8.0±1.4[a]	8.9±2.7[a]	8.6±2.2[a]	8.5±2.2	1.37	0.26
Still birth	1.57±0.5[a]	1.63±0.49[a]	1.57±0.5[a]	1.59±0.49	0.156	0.86
Litter size at weaning	3.3±0.7[a]	8.8±1.1[b]	2.9±0.3[a]	4.8±2.3	352.68	0.0
Birth weight (kg)	0.61±0.1[a]	0.8±0.1[b]	0.7±0.1[c]	0.71±0.1	26.99	0.0
Weaning weight (kg)	5.5±0.6[a]	7.5±0.6[b]	5.3±0.5[a]	6.2±1.1	208.96	0.0
Weaning age (day)	23.6±1.5[a]	23.6±1.5[a]	23.5±1.5[a]	23.4±1.5	0.186	0.83
Pre weaning mortality	3.86±0.55[a]	2.18±0.71[b]	4.17±0.65[a]	3.3±1.1	101.48	0.00

SD refers to Standard Deviation; [ab]values with one superscript letter in common are not significantly separated.

Table 2: Growth performance of fattening pigs under small scale intensive production in East Showa

	Towns					
	Addis Ababa	Bishoftu	Adama	Total	*Test*	
Parameters	Mean± SD	Mean± SD	Mean± SD	Mean± SD	*F-value*	*F-value*
Number of fattener	35(100)	40(100)	30(100)	105(100)	-	-
Fattening period(month)	5.9±0.3[a]	5.1±0.2[b]	5.9±0.3[a]	5.6±0.5	110.7	0.00
Average daily gain(g/day)	333.3±0.43[a]	487.5±1.0[b]	306.2±0.4[c]	384.3±82.1	66940	0.00
Final weight(kg)	60.3±9.9[a]	72.8.±6.0[b]	55.3±7.8[a]	63.6±10.8	45.8	0.0
Finishing period(month)	9.1±0.85[a]	7.6±0.5[b]	9.4±0.68[a]	8.6±1.06	75.2	0.0

SD refers to Standard Deviation; [ab]values with one superscript letter in common are not significantly separated.

The mean age at first furrowing of pigs was significantly lower (p<0.05) in Bishoftu compared to in Addis Ababa and Adama. The results implied that the pigs found in Bishoftu were matured earlier than Addis Ababa and Adama. The mean age at first furrowing of the current results were smaller than reports of Ate and Oyedipe [17]. In addition, this was a shorter period compared to age at first farrowing values of 319-417 days reported for other pig breeds including indigenous pigs Stasiak *et al*. [18]. Likewise, the average ages at first farrowing recorded in the present study was relatively lower than reports of Subalini *et al*. [19] and Kadirvel *et al*. [20].

The mean furrowing interval of pigs was significantly lower (p<0.05) in Bishoftu compared to in Addis Ababa and Adama. This might be associated with the extended suckling period of pig production in Addis Ababa and Adama than Bishtu town. This might have contributed to the delayed heat and invariably might have caused the long furrowing intervals. Sows with long furrowing interval could influence the prolonging of the duration of reproductive cycle of sows in the herd and reduction of the number of parities per sow per year. The mean furrowing interval of the current results were shorter than reports of Okello *et al*., Mutua *et al*., Petrovic *et al*. [16, 21, 22].

The mean Number of furrowing/sow/year was significantly greater in Bishoftu compared to in Addis Ababba and Adama. This might illustrate that the sows in Bishoftu conceive earlier than pigs in Addis Ababa and Adama after furrowing. A higher furrowing rate could result in more pigs born alive per bred sow per year. This could be associated with the diversity in early separation of sows from their piglets and put theme close to a boar, in a way that could make direct contact (hear, see, smell) possible to stimulate regular heat across the study sites. The present results were higher than reports of Wabacha *et al*. [23] and Iyai *et al*. [24] and Kumaresan *et al*. [25] and Lemke and Zarate [26] and Lemke *et al*. [27] and Roessler *et al*. [28].

The mean gestation period was similar (p<0.05) across the study sites. The results implied that pigs had shorter pregnancy period that could make fast investment return of pig production. The results confirmed reports of Nath *et al*. [29].

The overall litter size at birth was comparable with reports of Ikwap *et al*. [30]. It was however lower than 11 piglets at birth reported for smallholder pig production in northern Ethiopia [31]. The mean litter size of the current study was higher than that of Taiwanese pigs, Tanzanian native pigs and Zimbabwean native pigs [32]. Larger litter size at birth was reported by researchers in Swedish commercial herds [33]. Differences in both nutrition and management practices in tropical and temperate environments probably accounted for the disparity in values between the tropical and temperate environments. Feeding in the tropics is particularly not as adequate as in the temperate areas.

The mean stillbirths in pig production across the study sites might be associated with lack of furrowing supervision and timely intervention as needed which might reduce sow discomfort and piglet death during parturition. The present results were lower than reports of Okello *et al.* [15]. Furrowing season, furrowing length and parity had highly significant effects on both number of stillborn piglets per litter and percentage born alive [34].Thus, identification of risk factors associated with stillbirths could help to optimize reproductive efficiency of pig production.

The mean litter sizes at weaning of pigs were significantly lower in Addia Ababa and Adama than Bishoftu town. This could indicate that there was better preweaning care and survival of piglets and profitability in Bishoftu than Addis Ababa and Adama towns. The profitability of pig farm largely depended on the survival of litters up to weaning besides other closely related factors such as weight of piglets at birth [35]. The current results were smaller than reports of Rekwot *et al.* [5].

The lighter live weight at weaning of pigs in Addis Ababa and Adama compared to Bishoftu might demonstrate that pigs had lower growth rates post-weaning and were slower to reach a common slaughter weight. This could be attributed to increased feed intake of pigs that had larger weight at weaning. Similarly, pigs that were heavier at weaning performed better than those that were light [36]. Pigs weighing less than 5 kg at weaning (21 days) require 12 additional days to reach market weight when compared to pigs weighing greater than 7 kg [37]. This implies that maximizing weaning weight would help to ensure rapid post weaning growth.

The mean values of live weights at birth and at weaning were significantly higher (p<0.05) in Bishoftu than in Addis Ababa and Adama. The results suggested that there may be poor pre-weaning growth performance and survivability of pigs in Addis Ababa and Adama than in Bishoftu. The pigs with low birth weight grew slower than pigs with higher live weight at birth. The lowest daily gains were found in pigs with the lowest birth weight during their growing and finishing period [38]. Similarly, light pigs at birth required a greater number of days to reach the same slaughter weight than their heavier littermates [39]. Accordingly, pig farmers in Bishoftu could have been gained better economic benefit in contrast to farmers in Addis Ababa and Adama.

Weaning age was not associated (p<0.05) with location. The overall weaning age of pigs was 23.4±1.5 days. The current age at weaning could accelerate the growth performance of pigs. The result was similar with reports of Smith *et al*. [40] who stated that increasing weaning age from 12 to 21.5 days improved wean-to-finish growth performance in a multisite swine production system. Comparable values were also reported in northern part Ethiopia [3]. Conversely, the current result was smaller than reports of Mota *et al*., Phengsavanh *et al*. [4, 6].

Preweaning piglet mortality was higher (p<0.05) in Addis Ababa and Adama than Bishoftu.The variation in Preweaning mortality of pigs could be affected by numerous factors such as litter size, birth weight and order, furrowing duration, housing, flooring and management practices [35]. The present results of preweaning mortality were higher than reports of Pedersen *et al.*, Li *et al*. [41, 42]. The death of piglets might adversely affect the productivityof farms; therefore, implementing an effective management regime after birth could decrease the occurrence of piglet deaths.

Growth Performance of Fattening Pigs under Small Scale Intensive Production in East Showa: The study revealed that all respondents practiced pig fattening across the study sites. There were significantly shorter (p<0.05) fattening period and higher (p<0.05) market weight of pig farming in Bishoftu than in Addis Ababa and Adama. The reduced growth rate of pigs in Addis Ababa and Adama could be associated with the lower feed resource, feed quality and feed allowance. The results of the current study were relatively better than reports of Phengsavanh *et al.* [6], who found that pigs generally took nearly 2 years to reach a marketable weight of 60 to 70 kg. This equated to an average of daily weight

gain ranging from 100 to 140 g, which disagreed with the present results. However, the performance of pigs in small scale intensive farming system was generally very poor, as it might be affected negatively by nutritionally imbalanced diets and underfeeding. This might diminish the number of pig supply to the market that in turn reduced the income of farmers.

CONCLUSIONS

The main objective of this study was to analyze the reproduction and growth performance of pigs. It is explored that a diminution in pig mortality and stillbirth should go a long way to produce more animal protein to the community. The pig production performance in relation to reproduction and growth were affected by study areas, in view of the fact that differences were observed across the towns, specially issues linked with age at first service, age at first furrowing, furrowing interval, number of furrowing/sow/year, litter sizes at weaning and birth, live weight at weaning, Preweaning piglet mortality, average daily gain, fattening period and market weight. Thus, future research and development efforts in pig farming in central Oromia, Ethiopia should bear in mind the variation in performance traits of pigs of the study sites.

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